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NOTES ON ECONOMIC GEOGRAPHY.

BY

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FOREST RESERVES.—Part V of the 21st Annual Report of U. S. Geological Survey is devoted to this subject. It well illustrates the widening range of the Survey's work and the sumptuous character of its publications. We have a large volume giving a summary of work during the year 1899–1900, and detailed descriptions of several reserves. The volume is accompanied by a case containing 39 maps. These latter include a general map of the forest reserves and natural parks; and many smaller maps of large scale, giving distribution of trees and classification of lands. There is also a forest map of Indian Territory and a map of the pine lands of Minnesota. Mr. Henry Gannett is the author of the first paper, or summary of the year's operations. He gives an interesting table showing the years required for the various species to increase in diameter one inch on the various reservations. In a few cases there is such increase in less than four years, as, for example, the spruce, on the north and west sides of the Olympic Mountains and the Cascade Range, Washington; the Western White pine, Mount Rainier Reserve; and the redwood of Smith River, California. The redwood shows the most rapid growth of all. The slowest growth is found with the lodgepole pine, or tamarack, Colorado, and the whitebark pine and Patton spruce, Mount Rainier Reserve, the period for one inch of increase ranging from 11.7 to 14.5 years. The average for 55 cases, belonging to 16 species, is one inch in about seven years. In general, environment, more than species, determines the rate of growth.

The maps of the reserves afford an interesting study, and they may be cast into a few groups as an aid to the memory. We may distinguish a Washington-Oregon group, including the following reserves—the Olympic, Washington, Mount Rainier, Bull Run, Ashland, and Cascade Range. These aggregate 17,519 square miles, or about twice the area of Massachusetts, and all but the first lie in a nearly north and south belt along the Cascade Range. The Olympic Reserve is in the heavily-watered regions between Puget Sound and the Pacific Ocean. The reservations of the California group are: Lake Tahoe, Stanislaus, Sierra, Pine Mountain and

Zaca Lake, San Gabriel, San Bernardino, Trabuco Cañon, and San Jacinto. The first three follow the Sierran Range in eastern California, and the others make a northwest by southeast belt in the southern part of the State. The total area is 13,606 miles. The following make up the Arizona-New Mexico group: Grand Cañon, San Francisco Mountain, Black Mesa, Gila, Prescott, and Pecos River. All but the last two compose a belt stretching from the Colorado River to the southeast.

In the Colorado-Utah group we have: South Platte, Plum Creek, Pikes Peak, Battlement Mesa, White River, and Uinta, all but the last in Colorado. In Idaho, Montana, Wyoming, and South Dakota the reserves lie widely scattered, as follows: Priest River, Flathead, Lewis and Clarke, Bitterroot, Teton, Bighorn, Black Hills, and Yellowstone. The last lies on the east of the Yellowstone National Park, and the Rainier Reserve entirely surrounds the Mount Rainier National Park. The Yosemite National Park lies between the Stanislaus and Sierra Reserves. All the national parks and forest reserves are west of the 103d meridian. The total area of the reserves is 70,251 square miles.

Much of the volume is given to detailed township descriptions, but several passages are believed to have general interest. Thus the Lewis and Clarke Reserve in Montana is described by Mr. H. B. Ayers. The pines are of five species, and the forests include Engelmann and white spruce, two larches, two firs, two hemlocks, balsam, cedar, cottonwood, aspen, and balm of Gilead. This paper, like the others, is abundantly illustrated with good photographs. The reserve is estimated to contain 2,644,360,000 feet of timber. Relatively, little has been cut, mainly by ranchmen, and for the railways. An area of 1,420 square miles, nearly one-third of the reserve, has been severely burned in recent times. Here reforesting is postponed 100 years or more, owing to the loss of shelter and of the humus layer. Patrol was so effective that no fires occurred in 1899. Various other geographic data are given relating to soil and agriculture, irrigation, water-power, transportation, and mining.

Minute examination has been made of the Olympic Reserve. Here is much good land, but too inaccessible to repay the cost of clearing the timber. The heaviest forests in Washington, rarely surpassed in the United States, occur in this reserve. The average amount of timber is 24,000 feet per acre. Hemlock leads, then red fir, silver fir, cedar, and spruce. Little lumbering has been done, the rivers being too swift and variable for convenient log-driving. The mountains reach up to 8,000 feet, and grazing lands abound on the high slopes and ridges. There is no railway in the reserve, but a practicable route would follow the coast, with spurs leading up the valleys to the timber lands. Six maps in the case show the distribution of various sorts of trees in the reserve.

The Cascade and Ashland Reserves lie about equally on the east and the west slopes of the Cascade Range. This range is, in general, a plateau, furrowed with gorges and bearing volcanic cones. Crater Lake is here the notable representative of a group of lakes. As a rule, the region is wet on the west and drier on the east, with local modifications and exceptions. Yellow and lodgepole pine form 88 per cent. of the forest on the east slopes, and the broad-leaved trees but a fraction of one per cent. On the west the latter sort rises to six per cent. of the entire forest, which is thus heavily coniferous.

A passage of great interest in this section of the report discusses forest fires. There is no forested township in this reserve in which the timber is not somewhat fire-marked. Only 25,000 acres out of 3,000,000 have escaped. Some of the fires belong to the period of Indian occupancy, but by far the greater fires, and in greater number, have occurred since the coming of the white man. But, on the other hand, it is encouraging to observe that fires have become far less common during recent years. This diminution is due to the extinction of game and the smaller number of hunting parties, to private ownership of timber and better precautions, and to the destruction of the humus layer by earlier fires, so that it is not now present as a means of spreading them.

The Indian's reasons for setting fires were: that grass might grow near his camps and that he might destroy undergrowths and facilitate hunting. In some cases he may have sought the after-growth of huckleberry and blackberry thickets. The white man has fired the woods also for various reasons, or in various ways: as to attract game, to open roadways, to promote grass-growth, and through careless leaving of camp-fires. One case is cited in which fires were started to attract game. Half a dozen deer were obtained, and 15 to 20 million feet of merchantable timber were destroyed, the fire raging until put out by the fall rains. One fire was set to remove a windfall log from a road, and 3,000 acres of timber were burned. In some cases the soil, almost purely vegetable in constitution, is completely burned away, leaving the bare lava rock. In such cases many hundred years may be required to replace the soil and renew the forest. Another result is a great increase in the rate of denudation of the light, easily-moved pumice that in some parts forms the surface rock. This is cleaned down to the impervious rock beneath, thus removing an important spongy reservoir of the surface waters, insuring rapid run-off, and tending to produce desert conditions.

Another result of fires is a change in the composition of the forest, due to greater evaporation, less soil moisture, and the consequent dominance of trees suited to a drier soil. Thus, lodgepole pine replaces hemlock and fir. In some such cases reforestation by the pine brings back the soil moisture, and the hemlock and fir begin to regain their ancient grounds.

The yellow pine is considered to be the most resistant to fires of any tree on the Pacific Slope. Veteran trees of this species do not suffer from repeated fires, though the seedlings perish. White pine and lodgepole pine have thin bark and resist fires poorly. The same is true of the Alpine hemlock. About 20 per cent. of the fire-marked timber is "badly burned," this meaning a loss of 75 per cent. or more of the mill timber. The heaviest-timbered areas suffer most from fires. In the Cascade Reserve the fire loss, not including clearings for cultivation, has in the last forty years amounted to seven thousand million feet of mill timber.

In the report on the Stanislaus and Lake Tahoe Reserves a list is given of the sequoia, or big-tree groves, in California. They are eleven in number, containing from half a dozen trees to several thousand each. Names are given of the individual trees in Calaveras and Stanislaus Groves. Taking 30 of these sequoias, the height ranges from 235 to 315 feet, and the diameter six feet above ground is from 9 to 19.5 feet. The majority of the trees are believed to be under 2,500 years old, though the writer seems to agree with John Muir in conceding a greater age, even up to 4,000 years, for certain individuals. At two points in the Stanislaus forest reproduction is going on, but nowhere in the Calaveras group. In the former are dense patches of seedlings and saplings. The seedlings are from 2 inches to 4 feet high, and the saplings range from 10 to 30 feet. There is believed to have been no reproduction in the Calaveras Grove for forty or fifty years, as there the smallest sequoias are from 18 to 24 inches in diameter.

The waste of timber in these reserves is due to shake-making and lumbering. The shake-maker sought the straight, easily-splitting trunks, especially of the sugar pine, leaving enormous masses of top to rot or to increase the intensity and facilitate the spread of fires. Much the same is true of lumbering, great parts of the upper trunk being wasted which would be worked up in eastern lumber districts.

Sheep-grazing is more destructive than cattle-grazing, and there is a conspicuous absence of seedlings and larger undergrowth where the forest ground has been too closely occupied by herds and flocks. A great number of forest fires are also chargeable to sheep-herders. Some result from carelessness, and others are set to clear away logs and facilitate movement of flocks on their return—a most wanton procedure, requiring effective repression. The forest ranger may warn such trespassers to leave the ground, but he is likely to receive the answer that "bullets alone will be obeyed." Many trees are badly scarred, or even felled, by burrowing fires that persist on account of the resin in the wood. Shake-makers often chip the trunks to see if the grain is straight. The resin exudes and runs to the ground, the fires follow it up the trunk, and enlarge the scar from season to season, fed by the resin that accumulates in the intervals. Fires show surprising persistence in the green wood, and this accounts for the hollowing out of great trunks in that region. Sheep-rangers are found to be much more responsible for fires than cattle-herders. Milling operations cause many fires—some deliberately set to open roads, others catching from donkey loading engines. Few are due to campers and hunters, partly because such camping is usually near roads and settlements and partly because the game is nearly exhausted.

Public sentiment in the region is opposed to Government forest reservations. But many of the protests and the more violent objections come from grazers and other interested parties, and they should be taken for what they are worth.

The last paper of the Report deals with the pine region of Minnesota, and is accompanied by a somewhat detailed map, showing land and forest classification. Some of the statements regarding timber losses by fire are startling. The author quotes Professor Winchell's estimate that "annually ten times as much pine is destroyed in the State as is cut by all the mills. The State has lost in this way more than as much pine as now remains." In fourteen townships 836 million feet are known to have been burned—a loss of $240,000 to each township. Fire protection has accomplished much, but is unduly subject to local influence, and is yet imperfect. There is danger that the fears aroused by the great fire of 1894 will subside, and that suitable precautions will not be taken against the next very dry season that may occur.